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Science and Art Gossip.

THE suggested cricket changes continue to form the subject of letters in the *Times*. "Old Harrovian" suggests a limitation of the first innings to one hundred runs, with corresponding limit to second innings if reached. Another writer mentions an excellent plan adopted at Philadelphia to decide games which otherwise would be drawn, viz., by taking the average runs per wicket taken, in unfinished games. He also notes how much time could be saved if cricketers would only play up, instead of lounging through the game as they often do. One writer (Old Kennington Club) thinks the new arrangement suggested in KNOWLEDGE would not do, because ten minutes, at least, would intervene between each wicket! He omits to notice how much time is lost, as it is, between each wicket. Of course, the plan proposed there might easily be modified, so that the changes would not occur too often. Twenty overs might be played before any change, and followed by as many as would be necessary to take as many wickets as had fallen during those overs. Other details could readily be altered. But it is little likely (as was pointed out in the first paper on this subject in KNOWLEDGE) that any change will be made by the M.C.C. Cricket is too agreeable a lounge to be altered by any arrangement that would ensure a real contest in every encounter. It is said that nine-tenths of our amateur players prefer drawn games.

THE Jews as yet do not seem to have gained that hold in the United States which they have obtained in most European countries. It appears by the census of 1880 that in that year there were only 230,984 Jews in the whole of the United States. But the emigration from Russia has added some 17,000 to the number, so that the total Jewish population of the country may be estimated at about 250,000. Out of this number New York claims 80,518; Pennsylvania, 20,000; Illinois, 12,625; California, 18,580; and Ohio, 12,581—these five States thus containing more than half the Jews of the entire country. There are 10,337 Jews in Maryland, 8,500 in Massachusetts, 7,538 in Louisiana, 7,380 in Missouri, 5,593 in New Jersey, and the rest are scattered over the country from Maine to Oregon. More than two-thirds of all the Jews of the country are congregated in the principal cities. New York has 60,000; San Francisco, 16,000; Brooklyn, 14,000; Philadelphia, 13,000; Chicago, 12,000; Baltimore, 10,000; Cincinnati, 8,000; Boston, 7,000; St. Louis, 6,500; New Orleans, 5,000; Cleveland, 3,500; and Newark, 3,500. This determination of the race to the centres of population is also a noticeable characteristic of the Jews in Europe.

As illustrating how the prospects of electric lighting are advancing, it may be noted that whereas, on the inquiry before the Select Commission, Dr. Siemens said that *it was impossible to supply electricity for domestic lighting, from one source, over a greater area than a square quarter of a mile*, at New York 5,000 lamps were lighted simultaneously over a district of one square mile, only one source of supply being provided, the electric light running through eighteen miles of mains. In the district there are 1,500 consumers of gas, of whom 1,100 have subscribed for the electric light.

THE statistics of the latest census of France, taken at the end of last year, show some singular results, although they cannot, says the *Times*, be said to be re-assuring to those who are interested in the future progress of the country [at least if we are to assume that the prosperity of a country is proportional to the population per square mile.—ED.]. The fact that the whole of France has experienced within five years only an increase of 766,260 inhabitants, is a disagreeable one to be faced, as representing practically an almost stationary condition of population; but it becomes still more unsatisfactory, when we find that this increase, small as it is, has to be credited almost entirely to five-sevenths of the larger towns, and that the rural population is distinctly retrograding. The census of 1876, which fixed the number of arrondissements at 362, of cantons at 2,868, and of communes at 36,056, showed the population to be 36,905,788. At the present time it stands at 37,672,048. Of the 87 departments, 34 (mostly agricultural) show a decrease, the 53 which figure as increasing containing more or less manufacturing or commercial centres, such as Nord, with its iron and coal works and textile factories, in which the increase is 83,674; Seine (containing Paris), 388,480; Rhône (Lyons), 36,339; Bouches-du-Rhône (Marseilles), 32,649; Aude (Carcassonne woollen factories), 27,077; Pas-de-Calais, 25,822; Alpes Maritimes (Nice and Mentone), 23,017. Some of the decreases of departments are very considerable, such as Vaucluse, with the manufacturing town of Avignon as its centre, which has declined to the amount of 11,554 out of a total population of 255,703 in 1876; Marche is still worse, for with its naval stations and ports of Cherbourg and Grenville, it has declined by 13,533, and Calvados, containing Caen, Bayeux, and Honfleur, by 10,390. In forty-seven of the principal towns, we find assembled one-sixth of the whole of the French population, which is not a favourable outlook for moral, sanitary, or physical reasons. Paris has now a population of 2,269,023, or an increase of 280,217; Marseilles numbers 360,099, with an increase of 41,231; Lyons 376,613, with an increase of 33,798; at the rate of about 10 per cent. for the last three mentioned. On the other hand, Bordeaux, with a population of 221,305, shows an increase of only 6,165, which is to be accounted for by the presence of the phylloxera. With the exception of Marseilles, the French ports have not increased much since 1876; Nantes, with a population of 124,319, having increased by only 2,072;

Dunkirk, with 37,328, increase 2,647; Boulogne, 44,842, increase 4,767; Havre, 105,867, increase 13,799. The naval stations have declined, showing a curtailment of outlay—viz., Cherbourg, 35,691, decrease 1,495; Toulon, 70,103, decrease 406; Brest, 66,110, decrease 718. As a rule, the textile centres, such as Rouen, Lille, and Roubaix, show the most satisfactory rates of increase.

A very large number of both men and women [among the patients at Hanwell] are the victims of alcohol. One poor woman, who, after being at Hanwell for several years, was sent out, four years ago, perfectly cured, was back at the institution within ten days, and her case is now considered hopeless. When discharged she went back to her old trade of bookbinding, at the back of Fleet-street. Some of her old gin-drinking cronies enticed her into a tavern, and in less than a week she was a raging maniac. This is an old story. Scores of both sexes are confined at Hanwell whose lunacy is directly traceable to alcohol, but these by no means represent the number of its victims. Dr. Richards's estimate is that the lunacy of a full half of all his patients is the result of hereditary taint, and that a very considerable percentage of this may be credited to intoxicated parents.—*Weekly Times.*

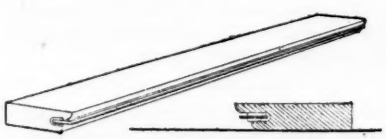
Sea Birds.—In a letter to the *Times*, "Femme du Monde" says:—Sir,—I beg of you to continue the campaign so well commenced in favour of the sea birds. The beauty they lend to the coast should alone suffice to protect them, without counting the value your correspondent justly claims for them as aids to the fishers and to the seamen. As it is quite certain that even good shots wound nineteen of these gulls to one that they kill, and lose very often even the rare few they do kill, it would be a million times better for all sea birds to be protected through all seasons. As it is for any birds the August days are far too early for the close-time to cease. *Apropos*, I cannot forbear from urging at this moment upon all women the necessity of setting their faces against the employment of birds in costumes and in bonnets. I am myself accused of being too devoted to the art of dress, and I go to the great Paris *couturières* and *modistes*, to whom one cannot, as a rule, dictate. But I make it at all times clearly understood, even by these, that I will not have birds put upon anything that I wear, and, of course, none are ever sent to me. It would be so easy for all women of the world to do the same, and the use of birds in costumes would then be left to the vulgar, who would in turn abandon it. I see in reports from America and Africa that those exquisite creatures, the humming-birds, are rapidly becoming so scarce from the millions that are caught and killed, that their total extinction is to be dreaded. Yet, despite this grievous fact, one continues to see costumes trimmed with whole fringes of these fairy-like children of the sun. It is in these things that women, especially women of position, can do so much if they will only reflect and exert themselves. The rough potting the beautiful storm swallow or the ocean gull, and the great lady wearing fringes of humming-birds are at the extremes of the social scale; but they are on one level in coarseness of fibre and cruelty of act.

The Stinging-Tree.—The "stinging-tree" of Queensland, Australia, is a luxurious shrub, pleasing to the eye, but dangerous to the touch. It grows from two or three inches to ten or fifteen feet in height, and emits a disagreeable odour. Says a traveller: "Sometimes, while shooting turkeys in the shrubs, I have entirely forgotten the stinging-tree till I was warned of its close proximity by its smell, and have often found myself in a little forest of them. I was only once stung, and that very lightly. Its effects are curious. It leaves no mark, but the pain is maddening, and for months afterwards the part, when touched, is tender in rainy weather, or when it gets wet in washing, &c. I have seen a man who treats ordinary pain lightly, roll on the ground in agony after being stung, and I have known a horse so completely mad after getting into a grove of the trees, that he rushed open-mouthed at every one who approached him, and had to be shot. Dogs, when stung, will rush about whining piteously, biting pieces from the affected part."

How to See the Attitudes of Animals in Motion.—A correspondent of the *Scientific American* writes as follows:—While experimenting in photography, I devised a kind of quick moving shutter, which I could operate with my fingers by moving a lever outside the tube. It occurred to me to look at animals in motion by merely putting the tube to my eye without any lens and operate the shutter. Immediately I had before me a series of instantaneous views without the costly appliances, and at will I could verify the strange attitudes set before us by the photographs of Muybridge. One who has not tried it will be surprised and pleased at the perfection and instantaneous character of the sights he will get of a moving object. It takes but a very short "exposure" to make the picture on our eye complete. The moving object is caught and shown to us just as it happens for the instant to be. Any device for opening the field of view quickly will answer, and in this way artists and scientific men can study the curious attitudes which any animal presents, and may reconsider, as Muybridge and others are doing, the conventional methods of representing a moving animal.

Benzine will answer much better to exterminate roaches, moths, &c., than anything else. It will not hurt furniture in the least, and can easily be applied.

Improved Ruler.—Mr. George L. Knox, Secretary of Colwell Lead Company, 63, Center-street, New York, has recently patented a ruler, by which the ink that may pass from the pen to the ruler is absorbed and effectually prevented from running down upon the paper to be ruled. This is an ordinary ruler having in one of its edges a deep groove extending its entire length, and in this groove is placed a folded plate of sheet metal. In the recess of the folded metal plate a strip of blotting paper or other absorbing



material is placed, the outer edge of which reaches to near the outer edge of the ruler, as shown in the annexed engraving. The metal of the folded plate has some elasticity, so that when removed from the groove the sides will open slightly to receive the absorbing strip, and when placed in the groove it acts as a spring against the walls for holding itself securely in place. The metal plate may be removed at pleasure for renewing the absorbing strip and for adjusting its edge at a proper distance from the edge of the ruler.

THE BRITISH ASSOCIATION.

By the Editor.

MANY seem to consider that our remarks on the British Association (regarded generally and also with special reference to the recent meeting at Southampton) have been unduly critical. We are open to correction, and if any one can show that the work actually done by the Association during the fifty years of its existence has been worth the time and labour bestowed on the meetings, to say nothing of some £100,000 paid by members and associates, we shall be very glad, in the interests of science, to hear the evidence. For ourselves, we must confess we cannot see that the progress of science is in any way advanced by these gatherings, while the dignity of science certainly seems to be impaired when in one city after another, Science comes before the public saying, "*Now* you shall have something good," and retires presently from a wearied community, which has heard very little that has been intelligible and scarce anything worth remembering. It seems to us that, despite the utter silliness of the *Times'* article from which we quoted last week, that desire to pose before gaping thousands as men who have done something no one else has done, which the writer of that article seemed to recognise in the suggested visit to Canada, must have something to do with these annual gatherings. Nor does the idea seem altogether absent that what that insolent writer said of Americans may be true of the citizens of the "good old towns" visited by Science. Men of science seem to think that "if they talk sense, they will be listened to; if they talk nonsense, they will be listened to all the same, and with the same degree of intelligent appreciation." Of course, in the utterly offensive sense in which these words were applied to Canada (and by implication to America generally, which has sent its men of science to Canada this year) this is very far from being true; but it *is* perfectly true that men of science who talk, as nearly all did at Southampton this year, in jargon which is as a strange tongue to their hearers, may talk nonsense and be no more understood than when they talk sense, in the same jargon: for neither one nor the other would be understood at all. If Sir William Thomson, for example, had spoken of ecliptic tides, or of electric tides, his remarks would have been quite as well appreciated by ninety-nine hundredths of his hearers as when he spoke of elliptic tides (meaning really the monthly waxing and waning of the moon-raised tides, as the moon moves nearer to us or farther from us in her elliptic orbit). In Canada, or the United States, or in Australia, where audiences are most thoroughly competent to distinguish sense from nonsense, "ecliptic tides" would have done as well as "elliptic tides," because both expressions belong to scientific jargon, and jargon quite inexact and misleading, since what Sir W. Thomson called an elliptic tide is not properly speaking a tide at all, and is assuredly not elliptic. There is, probably, not a man, however, in an audience so perplexed, but would be able to perplex men of science equally by the jargon of his own trade or profession.

Of the benefit these gatherings do to science generally we may gain some inkling by noting that in all the daily papers *utter absurdities* were published professedly as reports of the meeting. We need not go beyond the case just referred to—Sir W. Thomson's Discourse on the Tides. The *Times'* report of that discourse, for instance, was altogether absurd. Passages absolutely essential to the sense were omitted by the reporters, in calm confidence that the nonsense thus produced would be read "with the same degree of intelligent appreciation as the rest." And the confidence was justified. The weekly journals (even some which, like the *English Mechanic*, claim a scientific character), as placidly quoted this egregious nonsense, as if it had been profound science. Handed to a leading-article manufacturer, the report became the basis of one of those "*Times* articles," in which the British public places such implicit reliance, wherein, on this occasion, ordinary cyclopædic information about tidal waves was associated with certain electric tides (an ingenious new reading for the ecliptic absurdity), of which Sir W. Thomson, with sly sarcasm, remarked that they were "not to be wondered at." Yet the sarcasm touches himself also; for if such nonsense as electric tides "need not be wondered at" in a *Times* leader, the fault resides nearly as much in the jargon of the scientist as in the ignorance and presumption of the article-monger. How is the world to be taught science if men of science will not even *try* to speak intelligibly?

Even, however, those papers which have united in raising the chorus of adulation, have been obliged to admit that the splendours of science which they laud have not been altogether appreciated. "We hear the meeting spoken of as tame," says the *Times*, in an article almost as silly, though not quite so offensive, as the other; "but we have not been able to detect any sign of greater tameness than usual" [which is very likely]. . . "The Southampton meeting is no unworthy successor of the York Jubilee. . . Southampton has not been treated to the mere leavings of that great feast! . . British science has suffered no collapse after the excitement of last year!" . . [As if science were likely to collapse because there was a scientific meeting a year ago.] "It is marvellous how, year after year, there should be such abundant evidence of continued and fresh work! . . We cannot detect any signs of falling-off this year in any respect. Workers seem as eager as ever to come forward and tell what they have been doing," &c., *usque ad nauseam*. The unscientific public, it should have been added, seem just as unwilling to listen to them, which also "is not to be wondered at," since most of them will not express themselves in clear and simple language.

SIR W. THOMSON ON THE TIDES.

SIR WILLIAM THOMSON'S discourse upon the Tides at the Friday evening discourse, during the meeting of the British Association, was not, properly speaking, a lecture. A series of statements, scarcely connected at all, were poured upon the audience, to the manifest bewilderment of all except a few, who, having been acquainted with the subject and Sir W. Thomson's way of presenting it before, were entertained by his vivacity and by his obvious enjoyment of the effect he was producing. The real subject of the lecture was reached some five or ten minutes before the discourse came to a close.

Under these circumstances it is absolutely impossible to give either a full report or an abstract of the lecture, in such a form as would interest the majority of our readers. We propose, then, simply to select such statements from the lecture as are of intrinsic interest or importance, without attempting to do what the lecturer did not care to do—to present them, that is, as parts of a clear, consistent, and luminous discussion of the subject of the tides:—

From calculations by Mr. G. H. Darwin, the rigidity of the earth, as a whole, is about the same as that of a globe of homogeneous steel as large as the earth.

In some parts of the earth no lunar tides can be recognised, only a rise and fall occurring, either once or twice in a solar day. These may depend on meteorological causes, as on winds, or changes of temperature, due to solar

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action. They would in this respect resemble the diurnal change of atmospheric pressure, shown by the barometer's greater height at about ten forenoon and evening, and depression at or about four morning and afternoon. We must also remember, in explaining the annual solar tide, that, besides effects due to the sun's varying distance, there are annual meteorological causes of variation. Thus there are the monsoons and trade winds, changing with the seasons of the year. These, however, are not tides. [One passage in this part of Sir W. Thomson's discourse was very singularly reported in the *Times*, thus: "The results of observation are utterly inexplicable on the theory of gravitation,"—a statement calculated to delight the hearts of Hampden, Newton Crosland, Parallax, and the whole race, in fact, of anti-gravitational paradoxers. It should hardly be necessary to say that Sir W. Thomson made no such statement. What he really said was, that outside the movements of water due to the attraction of the sun and moon, there are others not to be so explained. To some newspaper reporters this would be quite the same thing, of course, as saying that the observed movements are quite inconsistent with the theory of gravitation.—Ed.]

"But does not the weather change with the moon?" [A manifest digression, carefully reported, however, as a part of the evidence relating to the tides.] Careful observations with the barometer, thermometer, and anemometer [that is, careful observations of the varying density, temperature, and movement of the air] have failed to establish any relation whatever, and have proved, on the contrary, that if there is any dependence of the weather on the phases of the moon, it is only to a degree quite imperceptible to ordinary observation. [To myself, constantly asked to say whether the moon influences the weather, and if so, in what way and in what degree, it is a comfort to find—however unexpectedly—a statement on this subject by Sir W. Thomson. Lunar and planetary influences, Mr. H. A. Bulley tells me, are not duly considered by science, and he manifestly doubts me when I say they receive all the attention they merit. Sir W. Thomson's statement is clear enough on this point, and will, therefore, be good for many readers of Knowledge (and especially, Mr. Bulley, for you).—Ed.]

To return to the tides.

The first rough view is that the moon attracts the waters of the earth to herself, heaping them up on her side of the earth. That would be the case if the earth and moon were stuck on the two ends of a strong bar and put at rest in space—a state of things which does not actually exist.

Why does not the moon fall to the earth, as according to the Newtonian theory it is always doing? Because it has a motion perpendicular to the direction in which it falls, and the continual fall produces merely a continual change of direction. That is the dynamical theory of what used to be called centrifugal force. The parts of the moon nearest to the earth are those which tend to fall most rapidly, the parts farthest are those which tend to fall less rapidly.*

Now as the moon moves round the earth, constantly falling towards her, so does the earth revolve round the moon, or, more correctly, each revolves round the common centre of gravity of the earth and moon. Each preserves a constant distance, or very nearly a constant distance, from the common centre of gravity of the two. The earth, as a whole, experiences an attraction depending on the average distance of its parts from the moon; but its parts nearer to the moon are more strongly attracted, and those farther from the moon less strongly attracted, than those at this average or mean distance. The result clearly is a tendency towards the moon and from the moon. Thus, in a necessarily imperfect manner, is explained how it is that the waters are (*not* heaped up on the side towards the moon, but) drawn up towards the moon and fall away from the moon, so as to tend to form an oval figure. [An explanation, however, which is altogether misleading, as no one could know better than Sir W. Thomson himself; only doubtless he felt that the true explanation was beyond the capacity of most of his audience. There *is* that tendency towards and from the moon; but the dynamical tendency is not at all to form the oval figure shown in textbooks, with the *longer* axis directed towards the moon, but to form an oval figure—the section of an ellipsoidal water surface—with its *shorter* axis directed moonwards.—Ed.]

As to the difference of the tendencies of matter towards the earth's surface, on account of lunar attraction, Sir W. Thomson stated that, when the moon is either overhead or directly under foot, the weight of a body at the earth's surface is diminished by a 6,000,000th part, as compared with the weight when the moon is ninety degrees from the vertical.* Or again, a plummet will be drawn aside by a 12,000,000th part of its length when the moon is ["off the vertical," says the *Times* report, complacently followed in many weekly papers] ninety degrees from the vertical.

The earth does not yield under the influence of these disturbing forces, because of her enormous rigidity regarded as a whole. Mr. G. H. Darwin's results, referred to above, conclusively dispose of the theory that the earth is a mere crust, forty or fifty miles thick, and full of molten lava.

There is a tide—really a tidal variation—depending on the moon's change of declination, which has, of course, a half-monthly period, the moon being on the equator twice in each lunar month. This may be termed the fortnightly or lunar declinational tide. [There is, in fact, as Sir W. Thomson subsequently explained, a slight heaping up of the water round the equator and lowering at the poles, once a fortnight, when the moon is crossing the equator, alternating with lowering round the equator, and heaping up at the poles when she attains her extreme north and south declination.] There is also a tidal variation which [if we want to confuse an audience] we may call a tide, due to the moon's varying distance in each lunar month. This tide, whose period is, of course, monthly, may be called the *elliptic tide*, because it depends on the ellipticity of the earth's orbit.

In a newspaper report it is bound, of course, to appear as the *ecliptic tide*, while in an amazing "leader" which adorned the pages of the *Times* for Monday, August 28, this tide appears as the *electric tide*, "an error little to be wondered at," writes Sir W. Thomson in the *Times* for Wednesday, August 30,—a remark whose biting sarcasm seems to have escaped the attention of the editor (or who-

* Just here the *Times* report, carefully copied in certain weekly scientific (!) papers left out—after the manner of such reports—several statements which served to connect what had thus far been said about the moon with tides on the earth! The report simply went on to say that "each preserved a constant, or nearly constant, distance between the common centre of gravity of the two," which, following directly upon a statement relating to the farther and nearer parts of the moon, could only mean that the outer and nearer parts preserved such a distance—utter nonsense, of course; but of such nonsense the newspaper reports of lectures commonly consist. Scarcely more absurd was the substitution in the *Times* of *ecliptic* for *elliptic* tides, a mistake also carefully reproduced in the *English Mechanic* and other weekly scientific organs!

* Here, again, the *Times* report was utterly absurd, though here again it was followed by several scientific papers. It stated that the weight is diminished when the moon is overhead, and increased in the same degree when the moon is under foot, in each case by one-6,000,000th part—an egregiously incorrect statement.

ever attends to such matters). [It is little when, in a report, an elliptic tide is called an ecliptic one, but really matters have reached a pleasing pass when Sir W. Thomson gravely tells the editor of the *Times* that it is not to be wondered at, if in a leading article which is even condescendingly explanatory, an electric tide appears upon the scene.—ED.] The moon is alternately nearer to and farther from the earth by a difference of about 26,000 miles (13,000 miles on either side of her mean distance) a little more than one-tenth of her average distance, in [very nearly] the monthly period of her revolution in her elliptic orbit.

Lastly, Sir W. Thomson mentioned the experiments carried on by Messrs. G. and H. Darwin on a pendulum so delicately suspended as to be sensible to the smallest influences. They found incessant vibrations, which show that the earth's surface is constantly palpitating, so to speak, chiefly from local disturbances. These palpitations were in fact minute and unceasing earthquake tremors, completely masking the delicate regular periodical variations which their pendulum would have shown had the earth been worthy of its name—*terra firma*.

A STUDY OF MINUTE LIFE.

BY HENRY J. SLACK, F.G.S., F.R.M.S.

POSTPONING for the present a further consideration of the microferments, the wants of young microscopists may be met by a dip in a waterbutt, or shallow pond in a sunny situation. Besides other creatures likely to reward the experiment, it is probable that the eggs, larvæ, and pupæ of the common gnat may be caught, and will amply reward careful examination. The female gnat lays eggs of long, conical shape, and glues a number of them together so as to form a floating raft. They are too small to be readily recognised by an unpractised eye, without a hand magnifier, but if any specimen of water contains larvæ and pupæ, small brown masses floating on the surface may prove to be eggs. When hatching-time arrives, they split lengthwise, and out comes a most curious creature, which grows pretty quickly, changing its skin by frequent moultings. A few ounces of water obtained as mentioned, will probably exhibit larvæ in various stages of growth. A two-ounce wide-mouthed bottle, just filled from a water-butt, contains scores of them, many about one-eighth of an inch long. Holding the bottle up to the light enables the naked eye to see them as wormy-looking things, with big heads and a many-jointed abdomen, curiously forked at the lower end. Many move about briskly by flicking what may be popularly called their tails; others are suspended upright, head downwards, and quiet, just keeping one of the forked ends out of the water; others are in a similar position, but completely immersed. The moving ones are violent in their jerks, which indicate great muscular power in proportion to their size. Closer examination with a magnification of about fifty times shows the internal structure through the transparent integument, and amongst other things it is seen that the creature is provided with the tracheal breathing-tubes belonging to insects, and that the prong of the terminal fork, which is often thrust just through the surface of the water, can open a way for them to receive the air. Probably the four leaf-like expansions attached to the other fork may serve as gills. At any rate, the active creature can stay for some time under water, and when a swarm of them are watched in a bottle, they will be found at various depths, some at the bottom, and, as in the case before us, few caring to come often to the surface for a gulp of fresh air. When not jerking about, they either float head downwards, almost stationary, or slowly sink, and then with a kick dash the water behind them, and rise up again. Their motions are in all directions, and though scores are moving briskly in our bottle, which is less than two inches in diameter, collisions are rare.

After well examining their ways in the bottle with the naked eye and pocket lens, one or two should be transferred to a small shallow glass cell, and a power of about a one-inch objective employed. The great roundish head is thus seen to be broadest near the base, with two conspicuous black eye-spots, and to be furnished with two large antennæ, and numerous bristles. It is a fierce-looking object. At about one third from the tip, each feeler has a large tuft of bristles, a smaller one above it, and a terminal bunch. Next to the head, which is very movable, comes a wide thorax, followed by a ten-jointed abdomen, bristled ornamentally on both sides of each joint. If the light from the substage mirror of the microscope is thrown a little slantingly through the creature, two large vessels of a satiny aspect are seen to run one on each side of the thorax through the abdomen, and into a tube that springs from the eighth joint of the abdomen. From the thorax smaller objects of the same sort spring from the larger ones, and enter the head. These objects are the breathing-tubes (*tracheæ*), and their peculiar sheen in glancing light comes from the coils of wire-like material that keep them open. For collecting food, the mouth is furnished with two tufts of bristles, fan-like when expanded, and used, like the so-called wheels of rotifers, to lash the water into whirlpools, and bring floating particles into its gullet. Only very small objects are swallowed, but when they are massed together in the intestinal tube, they make a considerable show.

Besides the tracheal tubes and intestinal canal, a long vessel is seen rhythmically pulsating—acting like a heart.

After these objects have been well examined with an inch-power, a half-inch may be used with advantage. This enables the structure of the tracheal tubes to be more distinctly seen in their minute ramifications, taking air to all parts of the little animal. Many of the bristles will also be found elegantly feathered, and the muscular bands with which the vigorous motions are effected may be discerned.

What is called dark ground illumination gives these creatures a splendid appearance under a low power. They look self-luminous, and shine with brilliant pearly and opalescent tints. The principle of this illumination is that no light reaches the eye straight through the object, but only such rays as are refracted by it. With a little practice, it can be managed by a slanting action of the substage mirror, but a finer effect is obtained by a spot-lens, that is, a lens which has a patch upon it to stop the passage of light excepting through the margin which is left clear. This is placed at a suitable focus under the object, which is made to glow brilliantly upon a dark ground.

Besides the great larva, the pupa must be looked for, and if a lucky dip is made, it is sure to attract attention from its grotesque oddity, though no one not in the secret would imagine it had any connection with the larva, or would ultimately disclose a winged gnat. It is a queer, bigheaded thing, with two hornlike projections and a slender, tail-like abdomen, sometimes curled close to the body, and then violently jerked to make it dart through the water. The breathing tubes of the larva terminate at the tail end, as we have seen; those of the pupa end in the two horns which it thrusts through the surface of the fluid

when it wants a supply of fresh air. A careful examination of this creature enables the wings and other parts of the future gnat to be seen inside it, folded up neatly and compactly. The compound insect eye is also well seen by throwing light upon it. The student keeping a supply of these objects and watching them from time to time, is sure to be rewarded by seeing the little monster split open, and allow the gnat to crawl forth and unfold its moist and glittering wings. If caught and mounted as a slide-object, the fresh plumes with which wings and body are decorated make a beautiful display.

WAS RAMESES II. THE PHARAOH OF THE OPPRESSION?

By Miss Amelia B. Edwards.

IX.—THE LAND OF GOSHEN.

THE territory so familiar to us under its Biblical name, "the Land of Goshen," was anciently an Egyptian Nome, or province, called "Kosem." The ancient geographical lists sculptured on the walls of the temples of Abydos, Edfoo, Philæ, &c., enumerate forty-four of these nomes, twenty of which were in the Delta. Kosem was the twentieth nome of the Lower Country. Its capital—or, as we should now say, its county-town—was named "Kos," or "Pa-Kos"; in Hebrew, "*Gessen*"; in our Bible-translation, "Goshen." Under the Greek rule, Pa-Kos became "Phacusa;" but as "*Kos*" it survived in the Coptic tongue, as long as the Coptic tongue* remained a living language. As "Fa-Koos" it survives to this day in the Arabic name of a miserable mud village, close to the Aboo-Kebeer station on the line between Zagazig and Salaheeyeh. This village nestles at the foot of some ancient rubbish-mounds, beyond which lie undulating hillocks, covered in spring with waving corn-crops. These mounds and hillocks mark the site of that city of Goshen to which Joseph (being in attendance upon the Pharaoh at Zoan) hastened in his chariot "to meet Israel his father"; so showing, by the way, that Jacob and his house entered Egypt from some point south-east of Tanis.

The topographical limits of the land of Goshen (otherwise the nome Kosem) are not known; but the chief town, Goshen, probably occupied a tolerably central position in the province. It lay, at all events, to the east of the Nile, to the south-east of Tanis, and to the west of Lakes Balah and Timsah. Southwards, it is believed to have terminated in the valley called the Wady Toomilat, or Tûmilat, now traversed by the line of railway which connects Zagazig with Ismailiah.† A great wedge-shaped tract of desert now lies between Fa-Koos and Wady Tûmilat; but recent excavations connected with the modern Freshwater Canal and the new line of railway have shown that this is, at all events in part, a subsequent encroachment. At the time of the Hebrew sojourn, the whole of this wedge-shaped district was probably rich with pasture. It also received a share of the annual inundation; extensive beds of Nile clay having been found near Tel-el-Maskhuta‡ in 1861, by the engineers of the Freshwater Canal Company. These clay-beds—which, if Tel-el-Maskhuta be really the "Raamses" of the Bible, furnished the Israelites with material for the bricks with which they built the treasure-city of Pharaoh—were largely used in building the new town of Ismailiah.

Part of the old Land of Goshen is, however, still flooded yearly by the Nile, is still carpeted with flowers in spring, and, where aided by artificial irrigation, still bears its double and triple crop per annum. Upon the calm surface of its backwaters and canals, the lotus still spreads its broad leaves and opens its cup-like blossoms to the sun; and the groves of acacia, sycamore-fig, pomegranate, orange, banana, and palm, which surround its scattered villages, are still each

"A populous Paradise of bees and birds."

By these yet fertile tracts—the mere fringes of the old province—we judge how the land of Goshen may once have been in truth "the best of the land."

Except in the geographical lists before-named, I am not aware that any mention of Goshen the province, or Goshen the city, has yet been found upon the monuments. The latter can never have been a place of political importance. It was a market-town; a county town; a local centre where justice was administered—such a place, in short, as the modern towns of Minieh, or Girgeh, or Keneh—not a place likely to be mentioned in religious or historical documents. As a territorial distinction, the name of "Kosem" would seem to have become obsolete under the XIXth Dynasty; surviving only as a legal archaism in the lists. We have, at all events, the evidence of the Book of Exodus, and the testimony of several Egyptian documents, to show that, from the time of Rameses II., when the new "treasure-city" was built and Goshen city ceased to be the chief town of the province, the old name of the Nome fell into either partial or complete disuse, and the "land," or county, of Goshen came to be called after its new capital, "the land of Rameses."

That Wady Tûmilat formed a part of the land of Goshen is a fact which has not been questioned even by those who dispute the identification of Tel-el-Maskhuta with the treasure-city of Pharaoh. It is a valley running almost due east and west between Zagazig and Ismailiah; the distance from Zagazig to Ismailiah being 47½ miles, and the length of the valley about 28 or 30. Every traveller who journeyed by railway from the one terminus to the other before this war began, caught pleasant glimpses of that green and winding track, and of the heron-haunted canal, fringed with reeds and water-plants, which runs through it like a silver thread in the middle of a broad green ribbon. To the north of the railway line, all is grey desert. To the south, beyond the canal and the Wady, all is desert again. Here and there, (unseen from the railway-carriage windows) the scenery of the Wady is varied by scattered ruins and mounds of ancient towns — Tel*-Aboo-Sooleyman, Tel-el-Kebeer,† Tel-Retabah, and Tel-el-Maskhuta. The two former have by different authorities been suggested as the site of Pithom; while in 1845, when Lepsius visited the East of the Delta, the modern village situate at the foot of the mounds of Tel-el-Maskhuta was still called by the name of "Ramses." There is a station at this point, where, but the other day, the trains used to stop, while the Arab guard shouted "Ramsis! Ramsis!" Now, at the moment when I am writing these words, Rameses is the site of the

* The Coptic (now a dead language, and used only in the services of the Coptic Church) was a late form of Egyptian, just as Italian is a late form of Latin.

† This valley, as I pointed out in last week's number, is the actual seat of war.

‡ This mound, it will be remembered, is variously written Maskhuta, Masroota, Mashuta, and Mahuta.

* "Tel" or "Kom" (Arabic) signifies a mound. "Tel" is chiefly in use in Lower and Middle Egypt; "Kom" in Upper Egypt.

† Spelt "Kebir" by the newspaper correspondents at the seat of war.

Guards' Camp, and a battery of English guns is planted on the mound of Maskhuta.

It has generally been supposed that the name of "Ramsés" was given to this place by the French constructors of the line; but at the time of Lepsius' visit in 1845 there was not yet a foot of railway laid down in Egypt. The name of "Ramsés," or "Ramsis," is, therefore, in all probability as old as the period of the Hebrew sojourn.

(*To be continued.*)

THE AMATEUR ELECTRICIAN.

ELECTRICAL MEASUREMENT.—III.

THE next point we have to consider is Conductivity, or "that property of matter in virtue of which an electric current is propagated through it." All matter is not equally endowed with this property—that is to say, electricity does not pass with equal readiness through all the various substances with which we are acquainted. For instance, iron does not conduct, transmit, or propagate electricity so readily as does either copper or silver; nor does mercury so readily as iron, nor water as mercury. There being, then, a wide divergence in the relative conducting properties of different bodies, it may naturally be asked—Is there any line of demarcation or any definite law governing the facilities offered for the passage of an electric current? If we limit our inquiry to different masses of the same material, our answer will be in the affirmative; but no one has yet explained why copper should conduct better than iron, zinc, tin, &c. Nor will we attempt to accomplish such a task.

Ohm, who first formulated the law which bears his name, declared electricity to be propagated in a manner closely akin to the way in which heat is transmitted, and that the best way to study the laws influencing the more subtle force is to investigate and apply the laws generally acknowledged as governing thermal transmission. Since that time experiments have demonstrated the truth of Ohm's deductions. So closely, in fact, are the forces of heat and electricity allied, that the tables of co-efficients are almost identical—that is to say, bodies which readily conduct heat as readily conduct electricity, and *vice versâ;* and the same relation which exists between the thermal conductivities of different bodies, exists also between their electrical conductivities. Conductivity is a property inherent in all substances, but in different degrees—that is to say, every substance conducts a greater or less amount of electricity. There is, however, as is well known, a vast difference between the best and poorest conductors. Thus, pure copper conducts 6,754 million times as well as distilled water, and 16 million times as well as sulphuric acid. Water, again, is an infinitely better conductor than air, ebonite, sulphur, and very many other substances. Practically, the conductivity of such bodies is *nil.* The almost total absence of this property in some forms of matter renders them of vital importance to the electrician. The converse of conductivity is resistance, or, in other words, bodies which conduct well offer but little resistance to the passage of a current of electricity, and bodies which conduct but poorly do so by virtue of the greater resistance which they offer to the passage of the current. Indeed, as every substance offers a greater or less resistance, we can with advantage start with this property of matter, and classify substances rather in the order of their resistances than of their conductivities. So, then, we measure the transmitting value of a medium, not by the amount of its conductivity, but of its resistance. And in measuring resistance, it will be seen that we at the same time measure the work which a current of electricity performs in overcoming that resistance. We require, however, a standard of measurement, and what this standard or unit shall be is a question which has caused many heart-burning contentions, and which is not yet quite settled. The unit which has long been in use in England, which has, on account of its eminently scientific origin, been almost universally accepted, and which will soon be stamped with the authority of an International Congress, is known as the Ohm, or B. A. unit. We will not attempt to define its origin or derivation, but say simply that an Ohm is the unit of resistance, and is equal to that offered by 18½ inches of copper wire, ·004 of an inch thick (about number 40 gauge).

Resistance varies as the length of the wire, and inversely as its section, that is to say, in the first place that if a mile of wire offers a resistance of 25 Ohms, ten miles of the same wire will offer ten times the resistance of 250 Ohms; and, in the second place, if we use a wire so much thicker or larger as to double its sectional area, we halve the resistance. For wires of uniform make, it is evident that with equal lengths the sectional area varies directly as the weight. The effect of temperature upon resistance is very important. With metals, the resistance increases with the temperature, so that a piece of platinum through which an electric current is passing increases in temperature and resistance, sympathetically, until, if the wire is not too thick, the heat overcomes the cohesion of the particles, and the wire breaks. With partial conductors the reverse is the case. This is especially noticeable in the carbon filaments of the various incandescent lamps. The Edison filament, which, when cold, offers a resistance of about 180 Ohms, offers only 100 Ohms when heated to its full illuminating power. Nor is this feature unimportant in its influence on practical telegraphy. The waters of the Indian Ocean are generally very warm, and in consequence of this, the insulating properties of the percha in the cables is very sensibly reduced, their efficiency for telegraphic purposes being necessarily reduced in proportion. There are in general use two methods of measuring resistance, viz., the "Bridge," and the "Differential." These it will be our duty to consider very soon.

THE TREE-TOAD.*

By Mary H. Hinckley.

A RECORD of several seasons gives the appearance of *Hyla versicolor* in the spring, in Milton, Massachusetts, from about the 1st to the 10th of May. Tadpoles of this species I have found most abundant in the water of small, still, shadowy ponds near large trees. The eggs are attached singly and in small groups for a distance of one or two yards along the grasses which grow up and rest on the water. Unless the grass is parted they are not readily seen. The gelatinous substance surrounding the eggs is exceedingly thin. When first laid they are of a drab colour on the upper surface, which becomes lighter after a few hours in the water. The under surface is white; the extent of this colour varies; in some cases only a spot of drab is seen on an otherwise white egg. The period of egg-laying, according to my observations, extends

* Abstract of a paper published in the "Proceedings of the Boston Society of Natural History," Vol. xxi., Nov. 17, 1880, from the *American Naturalist.*

from the first week in May to July. The development of the egg is rapid, being accomplished within forty-eight hours. When first hatched, the tadpole is about a quarter of an inch long, of a pale yellow colour, dotted with olive on the head and sides of the body. During the first week the external gills are developed and resorbed. At the same time the olive colour gradually increases and deepens till it extends over the upper surface of the tadpole. A fine dotting of gold colour also appears on both upper and under surfaces. In the water, however, they look black. The holders, at first so prominent, disappear within ten days. The head and body are short. The tail is broad and thick. The eyes are prominent, set widely apart, and of a brilliant flame colour; the iris in some specimens is quartered by dark lines. The lips are broad. The nostril openings and two perpendicular lines on the muzzle, also a line from before the eyes down each side to the tail, are gold coloured. Transverse bars of the same tint on the upper edge of the tail are sometimes seen.

The tadpoles are shy and quick in movement as young fishes, moving through the water with the least perceptible motion of the tail. They do not collect together, but where there is room enough, each tadpole goes its own way independently. They are hardy, and, probably owing in some degree to their quick movements, are more exempt from mutilation by water enemies than other species, rarely losing eyes or tail.

When about three weeks old the hind legs are in sight as small white buds in front of the base of the tail near the lower edge on each side. An iridescence of great brilliancy is seen on the white surface of the abdomen and sides of the body. The head and upper portion of the body show a bluish, metallic sheen, and the tail, which is more or less flecked with brown or black, becomes in some specimens a bright red colour. It would be difficult to exaggerate the beauty of colouring of these tadpoles: it exceeds in brilliancy and variety any species found in this locality.

As the legs become more fully developed, the colouring of the head and body tends from dark olive to a light, greyish-green. In the seventh week the body begins to lose its roundness, and the arms are seen to be moved under the skin, as if the tadpole were impatient to get them free. The head then appears disproportionately large. At this stage the tadpoles vary from grey to pea-green in colour. They are found in the shallow water near the shore, where many fall prey to various aquatic birds. During the eighth week they appear to take little food; the arms are thrown out, the tail is gradually resorbed, the mouth developed, and the frogs leave the water. While a few specimens retain the colour of grey up to this time, nearly all will be found of various shades of tender green on the upper surfaces, bordered with different tints of grey or salmon colour. The abdomen is white. Green asserts itself much earlier in some specimens than others; but I have never seen a tadpole of this species develope into the frog that did not sooner or later become green. The markings on the back also vary in time of appearance; but the colouring of black on the head, body, and limbs, the smooth, shiny patch below the eyes, the granulated appearance of the skin, and the yellow colouring in the folds of the legs, usually appear in the order of their mention, and after the frogs have left the water.

Last season a small pond in an open pasture, about fifteen rods from a wood, furnished a good opportunity for observing their movements on leaving the water. From the 19th to the 24th of July, numbers of the young frogs, with tails in different stages of resorption, were found on the ground, weeds, and grasses about the pond, which by this time had become reduced by evaporation to a shallow pool. They represented a variety of shades of green; a few were grey, and occasionally one was scarcely to be separated in colour from the mud on which it rested. I observed those on the ground frequently capture the small spiders which were numerous there. As soon as they left the water their object, evidently, was to reach the wood. Apparently aware of their danger in this exposed journey, they drew attention to themselves, when approached, by continually springing out of harm's way; but after the shrubbery was reached they rarely made any attempt to escape when discovered, trusting wholly, like the mature frogs, to their disguise of colouring for safety. I found

HINCKLEY, DEVELOPMENT OF HYLA VERSICOLOR.

several of them on a small apple-tree which was in the line of their journey. They were on the new growth which was overrun with Aphides, and the frogs had assumed a deep emerald-green, so like the leaf that it was difficult at first glance to distinguish them from it. After they reached the wood I could trace them no further. I think it probable that some observers have mistaken *H. versicolor* at this age for the adults of another species of Hyla.

My knowledge of the frogs from this stage till they reach maturity is confined chiefly to those reared in a fernery. For the first three months they retained the green colour, as a rule, with occasional changes of tints of brown and grey, matching the earth or branches to which they cling. After that time shades of grey become the rule and green the exception. The black markings on the head, body, and limbs did not change, excepting to

vary in distinctness. Their food, which they never took unless alive, was Aphides at first, but soon flies formed their chief diet. During the day they commonly remained motionless, hidden behind the bark of the branches, with feet and hands, which are evidently extremely sensitive, compactly folded under the body, so that only their outer edges came in contact with the surface on which they were seated. Occasionally they would pat the discs against the sides of the body as if to moisten them. Their activity was reserved for the night, although rain, accompanied by a south wind, caused them to move about uneasily. About October 1 they left the branches and ferns and nestled away in the damp earth and moss, where they remained through the winter, unless exposed to a temperature above 60°. They took no food from the first week in October till the 14th of the following May, when I gave them their liberty. They were then placed on an oak tree, where, after climbing till a suitable crevice or hiding-place was found, they backed themselves into it, and became to all appearance like a part of the bark of the tree.

THE SEA-BATHING INFIRMARY AT MARGATE.

[In the following from the *Morning Post*, our readers will probably recognise the hand of one of the most esteemed contributors to KNOWLEDGE.—ED.]

ON Monday, Aug. 28, without public announcement, ceremony, or parade of any kind, was accomplished one of those signal acts of private benevolence by which our country and our century are honourably distinguished. That is to say, at the annual anniversary meeting of the directors and committee of the Royal Sea-Bathing Infirmary, Margate, Sir Erasmus Wilson presented to the chairman the keys of the new wing, which, at a cost of nearly £30,000, he had munificently added to that old and deserving institution. This new wing, entirely designed by that accomplished architect and able *littérateur*, Mr. James Knowles, the well-known editor and proprietor of the *Nineteenth Century*, consists of four spacious wards, four nurses' rooms, two day-rooms, a large swimming bath-house, and a chapel. The four wards are constructed to hold sixty-four beds, and could well hold more if required. Two of these wards measure 63 ft. in length by 24 ft. in width, and the other two measure 56 ft. in length by 24 ft. in width, the height from floor to ceiling being 16 ft. throughout. The nurses' rooms measure 15 ft. by 12 ft. Attached to each ward is a bath-room measuring 10 ft. by 9 ft., and a lavatory measuring 9 ft. by 7 ft. 6 in. The swimming bath-house measures 60 ft. by 30 ft., and is roofed by a huge skylight 27 ft. above the level of the floor. It contains 35,000 gallons of water, is surrounded in the usual manner by a platform some 4 ft. to 5 ft. in width, and is furnished at the upper end with a row of dressing-closets, containing each a wooden seat and pegs for clothes. The whole of this bath and the walls of the bath-house are lined with white porcelain-faced bricks, picked out in delicate bands of buff and blue. The wards, nurses' rooms, day-rooms, bath-rooms, lavatories, &c., are entirely lined throughout, walls and ceilings, with the same porcelain-faced bricks, picked out with the same tints of buff and blue. The special needs of the patients in this hospital (all of whom are sufferers from scrofula and other diseases of the skin) being sea-air, sea-bathing, cleanliness, ventilation, and an even temperature, everything has been designed and carried out with strict regard to these curative conditions. The walls are built hollow; so guarding against excess of heat in summer or cold in winter. The doors are all of double thickness. The system of ventilation is so arranged as to admit cold air from under the floors through the warm-water coil-cases which stand in the centres of the various rooms and form part of the warming apparatus; while the *vitiated air is sucked out above through valves just below the level of the ceilings, whence it is carried off through continuous air-tight metal tubes running along the hollow walls in connection with the furnace chimney-shaft.* By these ingenious contrivances an uninterrupted sucking action is kept up, and an unchecked supply and renewal of fresh air is provided. Additional ventilation is also obtained through the windows, which can be opened entirely or only let down at the top, the upper part being shielded by screens of wire-gauze, to prevent downward draught. Furthermore, and with a special view to rendering all the surfaces proof against the adhesion of contamination, disease-germs, dust, &c., the floors are all laid down in the hardest teak planking; the walls and ceilings, *being porcelain-lined*, are capable of being washed in every part, and the *very sash-lines to the windows are made of wire-cording.* Nor is this all. The whole new wing—chapel and swimming-bath excepted—is constructed with a flat terraced roof, supported on *shallow brick arches, which arches (crossing the rooms transversely overhead, and lined, like the walls, with white porcelain tiles) are furnished with iron channels, or gutter-pipes, to receive any condensed vapour which may rise to the ceilings from the atmosphere breathed by the patients. Hence no foul droppings and no return of vitiated air in any form is possible.* The terrace on the roof measures 350 ft. in length by 32 ft. in width, and is designed to form a breezy and delicious promenade for the patients. It commands an immense view of sea and shore, town and country, and has all the advantages of a pier, without being actually in the sea. An engine-room, constructed in the basement of the northernmost ward, contains engines for pumping salt and fresh water—the former for the swimming bath, the latter for warming and washing purposes, the motive power being an Otto noiseless gas-engine.

We have dealt thus at length upon the sanitary features of Sir Erasmus Wilson's magnificent gift, for the reason that many of these arrangements are *as novel as they are scientifically ingenious; and because the building is designed, and we believe destined, to serve as a model construction for future imitation.* It is but just to Mr. Knowles to add that the whole of these admirable adaptations of means to an end are his own invention. A sanitary problem was proposed to him by Sir Erasmus Wilson, and it is thus that he has solved it, to his own lasting fame, and the no less lasting benefit of others.

THE POISONOUS LIZARD.

AMERICAN naturalists declare the *gila* monster, known to science as *Heloderma suspecta* (Cope), or *horrida*, to be harmless, and are not satisfied with the evidence given by naturalists of the Zoological Gardens, in support of the theory that it is poisonous. "It is to be hoped," says the *Scientific American*, "that the matter will now be more fully investigated; it is barely possible that our American naturalists have prejudged the case." [Those who want to air their familiarity (real or assumed) with Greek, are not bound to speak here of naturalists, for they may say herpetologists—it sounds finer.]

With regard to the name of this animal, a writer,

XUM

C. C. H., in *Land and Water*, remarks :—"Heloderm is its name, *Heloderma horridum* scientifically. My only knowledge of the Greek language is that it is subservient to science, and zoologically defiant of gender and case, sometimes of spelling; therefore conjecturally *helo*, the first part of the generic name, may have reference to the pale yellowish or sunny colour of this creature, as certain flowers, helianthemum, heliotrope, and helianthus, are named from *helios*, the sun, as our botany books instruct us; and *derm* is certainly skin. Heloderm is of a pale ochre or maize colour, with a coarse reticulation of black marks all over it; and its specific *horridum*, deferentially inferring its terrible, dreadful qualities, is *not* given in slangy disgust, as is supposed to be the case with its neighbour, *Crotalus horridus*. 'Horrid rattlesnake!' exclaimed a lady visitor in my hearing. 'What's the use of calling *that* one 'horrid,' as if they are not all horrid!'"

The explanation of the name is erroneous. If the reference were to the colour of the sun, *helioderma* would have been the name. The reference doubtless is to the black marks on the skin, which were fancifully compared to nails (*helos*=a nail or stud); so that the name would be *nail-skin*. Why the adjective should be neuter, we fail to see. *Heloderma horridum* would imply that the skin is horrid, *horridum* agreeing with the neuter word *derma* (Gk.). But it is the animal, not the skin, which is horrid, and the animal is the *Lacerta*, of the species *heloderm*, or nail-skinned—a *Lacerta* called *horrida*, or *suspecta*, because of its real or suspected venomous qualities. Our contributor, Dr. Wilson, is certainly mistaken, by-the-way, in calling the animal *haloderma*.

FISHERMEN'S SUPERSTITIONS.

THE "Fisherman's Own Book" contains an interesting chapter on the above subject, from the pen of Capt. J. W. Collins, who says that the fact that fishermen seem to be more dependent upon luck than almost any other class of men, and that they are constantly meeting with events calculated to excite superstitions, may account to some extent for their being credulous. Among the fishermen's superstitions of which he treats are—a belief in lucky and unlucky sailing days; a belief in Jonahs; the superstitions concerning dropping a hatch in the hold, breaking a looking-glass, driving nails on Sunday, &c.; and instances are cited where such superstitions seem to have been well founded, and others in which they are shown to have been without any foundation.

Mr. Scudder, in his interesting report on the Greenland halibut fishery, treats briefly of the same subject. "The only difference between Sunday and any other day of the week," he says, "was that no nail must be driven on that day, for they said that would 'nail the trip.' Their superstitions are a little curious. The old notion that any enterprise commenced on Friday would be unlucky has, in a great measure, disappeared, on account of the fishermen having read in the papers a long list of great events that had happened on Friday. The objection to hammering on Sunday was so strong that the captain delayed fixing a part of the rigging from Sunday until Monday on this account. There is one superstition about which they are exceedingly particular. They will never leave a hatch upside down. I was in the cabin fixing the fire, and had taken up the hatch in the floor to get at the coal, which was kept in the bottom of the vessel, beneath the cabin floor. The hatch I had placed in such a manner against the side of the cabin that, if it had fallen down, it would have been bottom side up. One of the fishermen, whom I had always regarded as very sensible, seeing the hatch in that position, said to me, 'Mr. Scudder, don't leave the hatch that way,' and when I asked him why, he explained that if it should slip down it would be upside down, which would bring ill-luck upon the whole trip. I replied, 'Let's try it,' and knocked the hatch down on the floor bottom up. I do not remember of ever having been more surprised than I was to see him jump to turn the hatch over. He then said, 'I don't know what the captain would say if he saw that.' One of the fishermen told of a captain he was with who swore terribly at him because he pushed a dory off from the vessel with the bow of the dory toward the sun. I found, however, some difficulty in getting the men to acknowledge their belief in many superstitions, and I should not have found out those I have mentioned, had not the incidents spoken of called them into action. I think, as a whole, they were, for sea-going men, remarkably free from superstition."

UTILISING SMOKE FROM WOOD.

AT Elk Rapids, Michigan, is a blast furnace in which are manufactured fifty tons of charcoal iron per day. There are 25 charcoal pits, constructed of brick. Each pit is filled with 100 cords of hard wood, and then fired. The vast amount of smoke from these pits, which was formerly lost in the air, has now been utilised by Dr. Pierce, a chemist. Chemical works have been erected, which are thus described :—First, they have a circular tube made of wood, with pine staves 16 feet in length, bound together with heavy iron hoops. This tube is placed directly over the pits in a horizontal position, with an opening from each pit into the tube. At the end nearest the building there is a large drum containing a rotary fan propelled by machinery, the power of which is gas. That acts as a suction or draft for the smoke, which is conveyed into five stills filled with copper pipe 2½ inches in diameter. The boxes in which the pipes are situated are 20 feet square, 8 feet deep, made of heavy pine, and filled with cold water; these are all connected by copper pipes; they are connected with the main still 100 feet in length, 10 feet wide, 8 feet deep, filled with copper pipes 2½ inches in diameter in a horizontal position, surrounded with cold water, from this conveyed to a purifier, from which runs what is called pyroligneous acid, which is as clear as amber, with an unpleasant odour. From the acid is produced :—First, acetate lime; second, alcohol; third, tar; the fourth part produces gas, which is consumed under the boilers. Each cord of wood contains 28,000 cubic feet of smoke; 2,800,000 feet of smoke handled every 24 hours, producing 12,000 pounds acetate of lime, 200 gallons alcohol, 25 pounds tar. These articles have a commercial value in the manufacturing of various articles. The alcohol has been contracted to a firm in Buffalo, New York, for five years, they furnishing the packages and receiving it at the works at 80 cents. per gallon. The smoke from 40,000 cords of wood consumed per annum is thus made a source of much profit, as the works are nearly automatic.—*Boston Courier.*

THE application of dynamite to the breaking up of masses of iron too great to be broken by other means, was successfully tried near Chicago recently. A refractory chunk, "salamander," of twenty tons weight, was placed in a pit. A hole was drilled in the iron, and a charge of dynamite was inserted. Several bars of iron, weighing tons each, were placed over the pit in order to prevent small pieces of metal from flying heavenward. The cartridge was connected with a battery, stationed one hundred feet from the pit, and after the spectators had found secluded places, the word was given, and in an instant the twenty tons of iron that had previously stood all kinds of hammering, was reduced to fragments. The steel men were completely surprised, and admitted that a feat was performed that before was held impossible.—*Scientific American.*

ANOTHER EXPEDITION TO FRANZ-JOSEF LAND.—The *Dijmphna*, with the expedition of Lieutenant Hovgaard on board, sailed, as reported from Copenhagen, on July 18. It is the intention of Lieutenant Hovgaard to adhere to the programme originally announced, viz., to proceed first to Cape Chelyuskin and thence make for Franz-Josef Land, pushing for the north next spring in sledges. His ship of 150 tons burden has been strengthened for the ice both inside and out. He has provisions for twenty-seven months, and coals for fifty days, with full steam at six knots; besides which he has rigged the vessel as a three-mast schooner, with square sails on her foremast. He takes several sledges and nine dogs of a Newfoundland breed. The expedition consists, besides the commander, of Lieutenants Olsen and Parde, of the Danish, and Lieutenant de Rensis, of the Italian Navy, Dr. Barch as surgeon and botanist, and Mr. Holm as zoologist, Mr. Litonius (Swede), engineer, and Mr. Ernest, mate, beside a crew of fifteen men, one of whom, the Norwegian Sivertsen, was in the Vega expedition. They are to ascertain whether Franz-Josef Land really extends to the neighbourhood of Cape Chelyuskin; whether the conditions of the current and ice are such that a basis for further exploration can be reached here without too great a risk; and whether the eastern coast of Franz-Josef Land trends to the northward at this point. They propose to winter near Cape Chelyuskin, or on the south coast of Franz-Josef Land, if it can be reached, and they hope to return within sixteen months. Observations will be taken throughout the winter in accordance with the programme of the international expeditions.

XUM

Letters to the Editor.

[The Editor does not hold himself responsible for the opinions of his correspondents. He cannot undertake to return manuscripts or to correspond with their writers. All communications should be as short as possible, consistently with full and clear statements of the writer's meaning.]

All Editorial communications should be addressed to the Editor of KNOWLEDGE: *all Business communications to the Publishers, at the Office, 74, Great Queen-street, W.C.*

All Remittances, Cheques, and Post-Office Orders should be made payable to Messrs. Wyman & Sons.

**** All letters to the Editor will be Numbered. For convenience of reference, correspondents, when referring to any letter, will oblige by mentioning its number and the page on which it appears.*

"In knowledge, that man only is to be contemned and despised who is not in a state of transition. . . . . Nor is there anything more adverse to accuracy than fixity of opinion."—*Faraday.*

"Show me a man who makes no mistakes, and I will show you a man who has done nothing."—*Liebig.*

TO MR. PROCTOR.

[552]—Paradoxers can become indignant when contradicted, as you know, having, like myself, received some epistles from that "polite letter-writer," John Hampden. What, then, must be the state of mind of a paradoxer when his chiefest, his dearest, his pettedest, his fundamental paradox is attributed to another? You have done me this wrong, and, therefore, when next we meet, &c.

In your "paradox corner," page 250, you place Dr. Siemens on my rightful pedestal. The "ingenious paradox" of supposing—aye, of even assuming—that interplanetary space is occupied by water is mine, and mine only. Grove and others have filled it with oxygen and nitrogen, Sterry and Hunt with carbonic acid; but "water, water everywhere" is my paradox, argued and stated as the fundamental basis of my essay on "The Fuel of the Sun," printed in 1869, and published 1870.

Hitherto none of the orthodox have attempted to refute this paradox by a discussion of the arguments upon which it is based. Until they do so, I shall not argue seriously with them, but merely refer to Chapter III. of the above, and quote the following from "A Simple Treatise on Heat," written ten years later:—

"The water of our ocean being equally capable of evaporation into the dense air immediately above it, or the lighter air above the clouds, or all the boundless space stretching between the orbs of heaven, be that space a vacuum or a plenum, must thus evaporate, or have evaporated, into all the interstellar space until that space be saturated according to its temperature, and such space must have *some temperature*, seeing that it receives all the radiations of all the countless suns. Therefore, the fact that our ocean is not dried up indicates the existence of 'water, water everywhere,' filling all the interstellar and interplanetary space of the universe, and having its density proportionate to its temperature" (*i.e.*, the temperature of space).

The above passage is corollary to any exposition of the general elementary facts of aqueous evaporation, more especially of the law that water is evaporated into the space surrounding it and *saturates that space*, be it vacuous or filled with much or little of air or other gases; or, "in other words, that the limit of evaporation of liquid water into surrounding space is simply a function of temperature, and not of the previous contents of that space."

I have heard of people who affirm that space has no temperature, and at the same time that our sun, and all the other suns of the universe, are dying out or cooling down. These orthodoxers then take another breath, and assert that heat is force, or a mode of motion, and that force and motion are indestructible. Then another breath, and further assert that heat is transmitted by the oscillations, gyrations, collisions, &c., of material particles; then another, and that there are no material particles between the sun and the earth.

As I refer to orthodoxers, and not to paradoxers, I must write courteously, otherwise I should say that they do this all in one breath.

W. MATTIEU WILLIAMS.

[Is it paradoxical to suggest that there may be aqueous vapour in interplanetary space? A very clever correspondent of the *English Mechanic* in former times—I forget how far back—Mr. E. L. Garbett, used to maintain that some comets are aggregations of the water of space—I think he even adopted Whiston's notion, that the Biblical flood was brought about by a big water comet. That, of course, was paradoxical. But the idea of aqueous vapour in space is reasonable enough. Paradox comes in when we try to get terrestial hailstorms out of it.—ED.]

ARTIFICIAL STONE.

[553]—The utilisation of refuse opens up a large field for scientific investigation. Much has already been done, thousands of pounds have been saved annually, many manufacturers have arisen, and consequently work has been found for thousands of people, solely on account of discoveries made in this department of research.

A good example of making waste matter into a marketable product is afforded by the manufacture of artificial stone.

This stone can be used for a great variety of purposes, chief among them being for paving, edging for paths and gardens, but chiefly for building. It is easily worked, and can be made into any design, and at a short distance it cannot be distinguished from real stone. It has many advantages over real stone. It is much cheaper; it gets harder and harder for at least seven years; it does not break up in frosty weather; and lastly, it does not discolour when exposed to the atmosphere.

The larger kinds of stone-work are made in wooden moulds. A layer of plaster two inches thick, generally composed of one part of Portland cement and two parts of stone dust, is spread evenly over the bottom and sides of the mould; a mixture of brick rubble, broken up small, and coke breeze, both of which have been previously well washed, are worked up with Portland cement, and then put into the mould and rammed well in. Another layer of plaster is then put over this, and the whole left to dry for a week. The moulds and their contents must be kept under cover. This is specially needful in frosty weather, as if they are left out when freshly made for a single night the stones break all to pieces. But when once they are properly dry, they will stand any amount of cold.

The facing for paving stones, as they have to stand a good deal more wear, is made of a mixture of sand and Portland cement in equal proportions.

ERNEST L. R.

HIGHLAND CELTS.

[554]—In reply to A. H.:—(1.) Any person who reads and speaks Gaelic, or has a dictionary, knows that "donn" and "dubh" are in Gaelic as distinct as brown and black in English.

(2.) Tacitus, he says, uses a word meaning "unmitigated carrots." This word, however, also means golden and bright yellow, colours frequent amongst us Caledonians, but invariably tinged with brown. Tacitus himself shows that he means the latter, as he says it points to a German derivation of our race. That the Germans are a fair and not a red-haired race we all know, and A. H., not to go further, says so in his letter.

(3.) We have the astounding statement that Breadalbane lies south of the Grampians. I live in the centre of Breadalbane, with a range of the Grampians to the south. The battle of the Grampians was fought still further south.

(4.) A. H. says that but little Gaelic is spoken in our country parishes. To one living, as I do, near Killin, to put it mildly, this is nonsensical.

(5.) He says the Caledonians are described as a mixed race. I ask where? Certainly not in the ancient chronicles and ancient Gaelic poetry. Nor yet can it be found in unwritten tradition, usages, names of places and sculpture. In point of fact, Breadalbane (especially western) is the very acme of unmixed Caledonianism. All modern authorities I positively refuse to accept, as the bulk of them have no real knowledge of us, our language, poetry, usages, &c., and betray their ignorance at every turn, as "A. H." does.

Now for facts. On 27th instant there were present at Killin Public School 63 scholars, and of these 51 had brown hair and blue eyes; 11 brown hair and brown eyes; 1 red hair; and with black hair and black eyes, none. At Kenmore (eastern Breadalbane) Public School there are at present 100 scholars. Of these, 48 have brown hair and blue eyes; 43 brown hair and brown eyes; 6 red hair and blue eyes; 2 black hair and dark brown eyes; and *one*, a stranger, from London, black hair and black eyes. These are certified in writing by the respective teachers.

CHARLES STEWART.

BRAIN WAVES AND MEMORY.

[555]—May I compare or connect Dr. Muirhead's theory [Mr. Knowles's] given in KNOWLEDGE, Aug. 4, with a theory as to memory?

1. Physical memory—*i.e.*, the memory by which bodily movements are performed. Here, the frequent renewal of the same impression on the nerve cells by efferent impulses, and connected

with motor impulses started by the will, gives to a certain number of cell molecules a "set" in a definite direction. The cells tend to evolve impulses more easily in one direction—that is (2), the molecules tend to vibrate in a definite direction. The motion at last becomes automatic—almost purely reflex; that is, an efferent impulse, which might give rise to many varied forms of efferent impulses, has, by frequent renewal, come to be associated with a certain definite efferent impulse. Examples may be easily found of this.

2. Intellectual memory, connected with the acquisition of knowledge, &c. Bain says: "Renewed feeling occupies the very same part, and in the same manner, as the original feeling, and in no other part, nor in any other manner that can be assigned. Again, he supposes that a cell, once the seat of an impression, becomes specially set apart for that impression, and for that only. I have not his book, "Mind and Body," and cannot see the context at present; but this, according to the present fashion of explanation, seems to me to imply a "set" of the cell molecule, just as is believed to occur in connection with physical memory—that is, in memory, as a result of some impression received, certain groups of brain cells have developed a tendency for their molecules to vibrate in one direction rather than in another. When motion is communicated to these cells, it can only be in that definite direction; it gives rise to certain changes (chemical), which form the recollection of the impression, and which may in some cases be referred outwards from the sensorium to the end organs. There are several ways in which recollections arise. We may again meet with an object which gives rise to an impression we have experienced before. The impression sets those cell molecules in motion with less effort than normal—we recollect the impressions. Again, recollection may arise voluntarily. How does this occur? Again, involuntarily—impressions which we cannot trace to any sensory impression directly or by the association of ideas—*i.e.*, the correlation of certain groups of nerve cells.

Voluntary recollection does not seem to admit of explanation so far. It is with involuntary recollection that I would connect Dr. Muirhead's theory of apparitions. The formation of an impression at first originates an ether wave. This, if it should return to the vicinity of the nerve-cells, might affect them, causing the molecules to vibrate in the direction in which their motion has been determined. How this return is to occur, I don't see. An impression of a like nature undergone by another brain would originate an ether wave of the same nature, which, falling on brain-cells "duly sensitive," would, as above, give rise to the special impression connected with that ether wave. Two ether waves compounded might originate an idea by the action of molecules of about the same set. As to Mr. Knowles' friends, Damon and Pythias, may I suggest that the brains of two persons, who had been accustomed to be under the influence of the same impressions, mental and physical, would thus, on the hypothesis given above, pass into partial identity of condition as far as the molecular structure of corresponding brain-waves is concerned. I don't think it would be too much to say, on the hypothesis given above, that such brains would have a considerable influence over one another. [Please consider the two last paragraphs of the extract from Mr. Knowles to be inserted here.] Atomic movements of inanimate objects causing ether waves would cause the recollection of these same objects.

"Fools rush in where angels fear to tread." May I ask, as to your question to Dr. Muirhead, whether any special organ is necessary for the appreciation of these ethereal waves? The ether, circumambient, all penetrating, passes also between the cells and molecules of the central vertex. May not the waves of this ether act directly on the nerve molecules? As to how they act, even I am not a wild enough speculator to venture a theory just now. When asked to explain memory and such trifles, it is much pleasanter to retreat under the sepia cloud of "molecular action," "atomic change," *und so weiter*, than to confess our utter ignorance; but after all one feels rather doubtful as to the amount of satisfaction afforded by the explanation.

Edinburgh, *Aug.* 5, 1882. Dr. Jope.

DRUNKENNESS.

[556]—My experience is that drunkards live long, and do not die out speedily. Their children suffer for the acts of their fathers, and would no doubt die, only they generally decline to follow in the steps that have brought them disgrace and misery, and so our race becomes weaker and weaker. [Is this really the case? Are we *all* weaker than our grandfathers?—Ed.] For in these artificial days the weak live as well as the strong. Mattieu Williams's theory might have done for other ages, but it won't work now.

John Alex. Ollard, F.R.M.S.

[557]—The question of temperance societies and pledges is being actively discussed in Knowledge just now, but there is one *raison d'être* for them which has not yet come up there. It is said to be a folly for a man who does not feel the craving for drink, to give up, save for example, his enjoyment in a glass which does him no harm. But surely, in the present state of society, many men are placed in positions where they are in constant danger, unless they exercise much thought and system (and how few have these at command!), of being led into habits of drinking. Men, I mean, who frequent clubs, messes, and such places where wine and spirits are always going, and "nips" constantly pressed upon them by hospitable friends. Workmen, again, who have to go from house to house, and get beer given them at each. Now, I think you would heartily commend such men for abstaining (if they found alcohol did them little good) from playing with such an edged tool, just as one commends a resolution to abstain altogether from gambling or betting. *Facilis descensus Averno* is true of alcohol above all, and surely it is wise for young men at least to keep off the slope. Temperance societies in both sections have, I believe, done far more good thus, by making men *think*, than by curing a few drunkards, but it is a work that can obviously never be gauged.

W. Bevil Browne.

[It appears to me that men placed in such positions as our correspondent mentions, should at least make the resolution never, under any circumstances, to drink in public under the conditions named; but that need not render it necessary for them to refrain from such moderate and regulated use of alcohol as they may find wholesome and readily controllable.—Ed.]

FERGUSON'S MECHANICAL PARADOX.

[558]—I have never seen the book entitled "Remarkable Men," to which "Cupidus Cognoscere" refers in letter 522 (p. 219), and am therefore ignorant in what way Ferguson's paradox is illustrated there. As a matter of fact, it affords an example of what is known in mechanics as an epicyclic train. As usually constructed, a heavy base standing on the table supports a fixed toothed wheel, on the axis carrying which, and beneath it, an arm goes round; on this arm are two axes, one near its extremity carrying the three wheels of which your correspondent speaks, while the other carries an "idle" Marlborough wheel to transmit the movement. Let us suppose that the fixed wheel has 60 teeth, the "idle wheel" any number that is convenient, and the three thin wheels 61, 60, and 59 teeth respectively. Then it is pretty evident that when the arm is made to revolve round the fixed wheel, the wheel with the 61 teeth will advance slowly in the same direction as the arm; that with 60 teeth will remain stationary, and the wheel with 59 teeth will go backwards. "C. C." will, of course, note that the introduction of the intermediate or "idle" wheel, in no sense affects the principle.

A Fellow of the Royal Astronomical Society.

SPOTS ON THE SUN.

[559]—The date at which Mr. A. Green's query arrived in June, and the very unfavourable weather which followed its reception, prevented us from having the sketch of the sun-spot made which

Group of Sun-spots, August 24, 1882 (10·45 A.M.).

he asked for. We, however, now append a careful drawing of the beautiful group which was upon the solar disc at the date of its execution, in hope that it may serve his purpose.

CONSUMPTION FROM STAYS.

[560]—In the reference to "taper waists" [431], in your issue of June 23, page 59, "F. W. Harberton" [Viscountess Harberton] seems to ignore statistics, and to be ignorant of established physiological facts. Dr. Ridge [432], in the same issue, shows that more males die from phthisis than females, although, as F. W. H. says, fully 90 per cent. of women are deformed by stays, and it is not probable that over 10 per cent. of the opposite sex "lace." It is impossible for stays to produce consumption if Koch's theory is correct. If it is not, tubercles do not begin to form at the lower end of the lungs, where they are compressed, but in the upper part, which the corset leaves free. Females breathe higher up than men (thoracic breathing), and the effect of lacing in the waist is to expand the chest and upper end of the lungs, and thus check the growth of tubercles. Pregnancy also interferes with free and full respiration quite as much as tight stays do, but, instead of causing consumption, it affords, at least, temporary relief. Carl Both has shown that a person has three times as much lungs as are required in health, and hence neglects to use them all; if a woman chooses to dispense with the lower portions for a few hours a day, she rarely suffers from it. That injury may result from very tight lacing no one can deny, but the anti-corset men injure their own cause when they make false charges against an article that every woman wears, and knows to be less injurious than they say it is. By pointing out the real dangers of tight-lacing (dyspepsia, sterility, &c.), and not the imaginary ones, much good can be done. "Total abstinence" has injured the temperance cause, and he who preaches moderation accomplishes far more good; so it is with stays. Another error of F. W. H. is in supposing that "taper waists" can only be attained at the expense of tight-lacing, while the fact is that, in many cases, moderate pressure, judiciously applied, will make what he calls a "taper waist" without any lacing at all.

I am afraid the editor will refuse to print this letter, because it does not follow the old rule of abusing stays at all times and in every manner; but a scientific journal should consent to present *all* the facts, even if they *seem* to contradict preconceived ideas.

E. H.

[E. H.'s letter is printed in full, even the last paragraph, in which he rather unjustly suspects me of disliking moderate views. It so happens that on quite a number of subjects about which extreme views are held, I have expressed moderate views. I have advocated, or at least defended, the moderate use of stimulants, where many readers have urged me to Blue-Ribbonise KNOWLEDGE. I have held a middle course on the Vivisection question, opposing equally the brutalities of some vivisectionists and the colder form of cruelty which some anti-vivisectionists display. So far as I know, I have no extreme views on any subject. Even in dealing with the Endowment of Research, supposed by many to be a subject on which I am rather earnest, I have advocated reasonable State support in the very papers in which I have most strongly denounced scientific mendicity and Micawberism. I have acted on the rule, *Medio tutissimus ibis* (which a spiritualist friend translates, "You may very safely visit a medium")—or, rather, my idiosyncrasies tend that way. E. H's fears were ill-founded.—R. P.]

FLINT JACK.

[561]—It may be rather late, but as no one has satisfactorily answered A. Britland's question, I think the best he could do would be to write to the Curator of the Wilts and Devon Museum, Salisbury, where there is a large collection of forgeries, and a portrait of Flint Jack, *alias* Flint Willie, Shirtless, Bones, &c.

J. E. OKILL.

LETTERS IN TYPE.—Brain Troubles, by Dr. Jope; A Luminous Sea, by H. P. Vacher; Size of Rising Moon, by G. E.; Local Weather Lore, by Michael Rearden; Singular Mental Illusion, by W. H. Perkins; A Glass of Wine, by W. H. Johnston, and H. F.; Tarnished Daguerreotypes, by A. Brothers; Physiological Experiment, by Z.; Skeleton Leaves, by E. C. N.; The Use of Drunkenness, by J. Ralph; Talking Canary, &c., by Charles L. Cane; Turkish Tobacco, by Tunbeki; New Method of Preserving Organic Bodies, by W. Mattieu Williams; Defects of Bicycles, by John Browning and H. T. Round; Hot and Cold Drinks, by M. D.; Jordan-Glycerine Barometer, by C. J. W.; A Poisonous Lizard, by Solanum; Botanical Repulsion and Attraction, by Beccabunga; Singular Rainbow, by William Ackroyd; Mechanical Paradox, by C. T. M.

Answers to Correspondents.

*** All communications for the Editor requiring early attention should reach the Office on or before the Saturday preceding the current issue of* KNOWLEDGE, *the increasing circulation of which compels us to go to press early in the week.*

HINTS TO CORRESPONDENTS.—*1. No questions asking for scientific information can be answered through the post. 2. Letters sent to the Editor for correspondents cannot be forwarded, nor can the names or addresses of correspondents be given in answer to private inquiries. 3. Correspondents should write on one side only of the paper, and put drawings on a separate leaf. 4. Each letter should have a title, and in replying to a letter, reference should be made to its number, the page on which it appears, and its title.*

EGYPTIAN CHRONOLOGY.

HALLYARDS.—With regard to your note, for which I am much obliged, I can only say that I do not profess to be a chronologist, or to reconcile Bible statements which differ from each other. Believing the clear, straightforward, unvarnished tale of Exodus to be the original version, and the later variations mere departures from the original, I have preferred to accept the statements in Exodus, and to abide by them. I believe Abraham, for instance, to have been laid in the Cave of Macphelah, and not in Sychem, and I believe the sojourn to have been, *most likely*, 430 years in duration. But, as a fact, I doubt *all* chronological statements before the time of Shishak and the fall of Jerusalem. Up to that time I regard all chronology as merely approximate. We know how the most ordinary statements of events happening in our own day, when we have printing-presses and telegraphs, get garbled, magnified, and turned upside down by mere verbal repetition. And how much more must statements regarding lapses of time have become garbled, and magnified, and altered, when repeated from mouth to mouth, and from generation to generation, in ages when there was no press, no sifting of evidence, and no means of comparison? It must be observed that I have scrupulously avoided *fixing a date* for any of the events relating to Joseph, the Exodus, Rameses, &c. I have again and again insisted on the fact that I use figures and dates only for *convenience*, and that my dates are merely approximate, and may be shifted "up or down the scale of ages" to almost any extent. A. B. E.

JAS. DEANE. Many thanks for Mr. Russell's paper. He certainly presents the meteoric theory of the cold snaps in a much more effective form than any in which it has yet been advanced. I propose to present his theory presently in a paper which I will write on the subject. In passing, however, let me note that in the extract you send me a mistaken idea is advanced (without being corrected, as it should have been) that the August meteor system lies between the earth and the sun in February. This is certainly not the case..—F. W. wishes to know *how*, also (which is harder) *why* the teeth of cows differ from those of other quadrupeds.—HUNTINGFORD wishes to know how best to learn Latin without teacher.—J. F. SIMPSON. I am much obliged to you for sketch of R. W., but fear it will be long before space can be found. British Association pushes aside so much. Electricity in atmosphere in type. It is rather technical.—P. T. LETCHFORD. Letter about tricycles forwarded to Mr. Browning, who will note it. We are getting weekly more into arrears with letters, or would insert it.—J. PARRY. Probably what you saw was an August meteor, so near the radiant that its path was almost without apparent length,—in other words it was moving almost directly towards you. Saying that it appeared to you "about the size of a hen's egg, relatively," does not convey a clear idea of its apparent size. You should have mentioned how far off an egg would be to appear about as large as your meteor. Then again, what sort of hen?—M. TESTER. We have asked "Natator," and he tells us he thinks those india-rubber collars may be used without harm; they certainly help some learners; but you should only use them so as to learn as quickly as possible to do without them.—T. R. ALLINSON. Every one knows what a "caul" is; but if any one wants to sell a caul, and thinks some one may want to buy one, what is it to us?—W. G. S. notes that the stone objects referred to by W. M. probably do not exist in "flint," as it is doubtful whether there is true flint in South Africa. He refers readers to "Journal of Anthropological Institute," vol. xi., p. 129. — ALG. BRAY. You are quite right. The chance that the letters of the sentence "Up, Guards, and at them," will be drawn in their right order from an urn containing seventeen alphabets, or 442 letters, is not what I said in the number for July 31, but

$$\frac{17^{12} \times 16^{4} \times 15}{442.441 \ldots\ldots 427 \,.\, 426}.$$

I hope G. A. D. will notice the correction, and excuse my mistake—which I cannot explain. My answer implied that because there were 2 *u*'s in the sentence, there were 34, not 17, *u*'s in the urn, and so forth; but *why* I should have imagined this at the moment,

XUM

I cannot imagine now.—C. L. Cane. Your letter sent to printers, but may be delayed—eight or nine pages of letters waiting. —J. E. Hudson. What is there to explain? It is pretty obvious that if you buy 30 oranges at two for a 1d., and 30 at three for a 1d., you pay 25d.; while if you sell the lot at two for 2d., you get only 24d., or lose 1d. If you mean that one could expect antecedently neither loss nor gain, I would invite you to notice that by taking 10 sets of 20 oranges from the first lot, and combining with 10 sets of 3, made up out of the second lot, you can make up 10 sets of 5, for each of which you paid 2d. There remain 10 oranges of the first lot, for which you paid 5d. If now you sell these for 4d., you are antecedently likely to lose a penny by the transaction. If there had been 20 at 2 a penny, and 30 at 3 a penny, the 50 might have been sold at 5 a penny, with neither loss nor gain. Such proportions should always hold to make the bargain sound.—Tunbeki. Pray excuse long delay in thanking you for sample of Persian tobacco. I wanted your letter to appear long since.—A writer with hieroglyphic signature asks nine questions, most of which are such as only advanced students of astronomy would take interest in, and *they* would know the answers. Among the rest, occurs this question, "Is there any way to do subtraction and addition by logarithms?" Why, certainly. Thus, suppose you wish to subtract 2 from 7. Double the logarithms of 7 and 2, and find of what numbers the results thus obtained are the logarithms. Divide the difference of these numbers by the sum of 7 and 2; the quotient will be what you want. Some prefer to subtract 2 directly from 7.—Epsilon, who will soon be a Durham B.A., wishes to know the best means of becoming a surgeon in the least possible time. He lives near a good medical school at Owen's College, Manchester. —J. W. Boothroyd. Would insert your interesting letter if not overcrowded. It seems to me the good effect of exercise you mention arises from the stimulus to the circulation. Quite agree with you about the pleasant effect of a single glass of wine when mind is depressed or body wearied. Beware, however; it is a deadly poison; that single glass, perhaps once or twice a week, is absolutely certain to kill you in less than a century.—M. M. Williamson. Would return the letter on Blasphemy, but fear it was not preserved.

ASTRONOMICAL.

B. M., F. N. C. S.—"F.R.C.S." promises us to look at ζ Cancri and Struve 175 (Bird's Star near Castor) as soon as they come into a rather more favourable position. Just now it is between 3 and 4 a.m. before either of them is 30° high.

CHEMICAL.

Kelt.—For the Advanced Stage in Inorganic Chemistry, Science and Art Department, the following works may be studied:—Theoretical, Roscoe's "Elementary Chemistry," for Practical Analysis; Iago's "Inorganic Chemistry," published by Longmans & Co. The latter also gives a considerable portion of the theoretical division of the subject. (Answers to two other querists were inserted in No. 36, under the heading "Certo.")—Iota. 1. The flame from a Bunsen burner is hotter when air is mixed with the gas than when the gas is simply burnt in air, because the more intimate mixture of oxygen gas (a constituent of air) with the coal gas (composed of hydrogen and carbon) produces a much more complete state of oxidation or combustion.

BOTANICAL.

E. C. H. (Worthing).—Perhaps my explanation of the difference between geraniums and pelargoniums was a little too condensed. All pelargoniums have one sepal with a spur, the spur being combined with the flower-stalk or pedicle. The best way to understand their structure is first to take a common nasturtium or Indian cress (*Tropæolum majus*) and bend back its spur till it touches the stalk. Now, imagine the two firmly grown together, and you have exactly the arrangement of the pelargonium. There are always two petals more or less unlike the other three; at the base of these and between them lies the hollow tube or spur—the "small deep hole" which you mention. This runs along the flower-stalk as far as the little protuberance, where the honey is secreted. If you cut across the stalk with a pen-knife in successive slices you can readily follow up the tube to this point. A little examination will show you how the parts of the flower are specialised for fertilization by the butterflies which insert their long probosces into the tube. Observe especially that the stamens come to maturity first, and after they have shed their pollen, the stigma unfolds its five rays and turns upward so as to press against the breast of the insect which brings it pollen from another flower. The distinction you mention as to the leaves is quite unfounded.—S. Y. R. (Mosstown). Caper spurge (*Euphorbia lathyris*) is acrid and poisonous. I did not know before that it produced an eruption; but if you happened to have any slight cut on your fingers, some of the poisonous juice might easily have got into your blood. The plant derives its very misleading name from the fact that its capsules slightly resemble capers; but many people have been more or less poisoned by rashly concluding that they could pickle and eat them with impunity.

GEOLOGICAL.

Flint-Jack. I notice that no reply has yet been given to the query as to the time and place of the death (if he be dead?) of the celebrated fabricator of stone implements and other spurious antiquities, whose great misfortune it was to be born about five thousand years too late. When I became Curator of the Leicester Museum, in 1872, I found that the institution possessed several specimens of his handiwork; but a knowledge of his abilities had by this time become widely disseminated, and it is a fact that he was only able to sell some really good examples of neolithic flints by offering them as his own workmanship! During the next two or three years he was frequently an inmate of the Leicester workhouse. About this time I carefully watched his mode of chipping flint, and certainly his dexterity in manipulating that refractory substance was very great. After breaking a flint nodule in half with a heavy hammer, he would select a portion, and by smart blows delivered from the elbow, detach long, knife-like flakes, guiding and lengthening the fracture by the pressure of his fingers. The flakes so obtained he would fashion into knives, saws, &c., by rapid up and down blows of a thin iron rod, bent at one end. I often tried to induce him to attempt the imitation of some of the wonderful Danish daggers or spear-heads, made out of flint, yet not much thicker than cardboard, and having surfaces rippled in the most beautiful manner, Over these he always shook his head and repeated again and again. "'tis a *barbarious* art, lost to mankind!" One day, I think it was the autumn of 1875, he came to the Museum in unwonted alarm, and announced his intention of making an early departure, for "they were dying off like flies at the workhouse, and he would sooner die in a ditch." This was the last I saw of Edward Simpson; irreclaimable scamp and true tramp though he was, I cannot help a kindly feeling for him, and I should be glad to learn, with your querist, where and how his wanderings were ended.—W. Jerome Harrison.

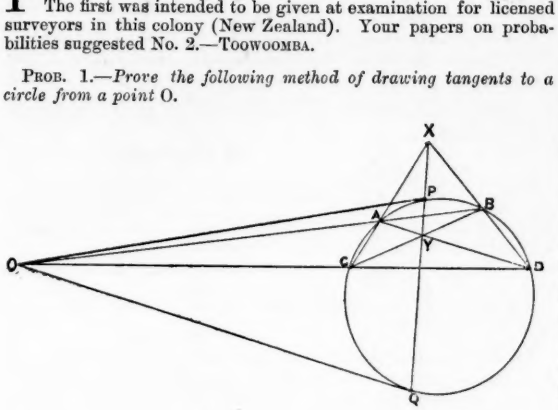
TRICYCLING.

Mr. Litchford.—I had had my attention drawn to the mistake in my article. It was by a slip of the pen that I described the "Humber" as a rear-steerer—of course it steers in a similar manner to a bicycle, by the movement of the front wheels. The truth is that I had in my mind the title of my article on the *form* of the tricycle, and your correspondent will see that in the case of the "Humber" there are two large wheels in the front and one small wheel behind. Possibly rear-steering machines may not prove well fitted for riding at the very highest or, in other words, racing speed. But I doubt if this would materially affect their sale. When, as Mr. Litchford states, the rear-steerer was found unsteady, both himself and his fellow-competitor were probably going at between twelve and fifteen miles an hour. Very few tricyclists care to ride faster than from eight to ten miles an hour, and at this rate of speed most of the rear steerers I have tried have been fairly steady, though they might have been improved in this respect by having the pedals brought underneath the rider, and the backbone lengthened in the manner I have indicated in my previous article. I think it quite possible that the greater number of tricycles will, for the future, be made of the front-steering type. For intending riders, who purchase a machine and wish to ride at once without any practice, a front steerer will be best, but I cannot admit that the rear-steering machine need necessarily be unsafe. My principal object in writing my article was to point out that the bad reputation this class of machine has acquired has been due to errors in construction. Last year I had an ugly accident myself while riding a "Salvo," which I believe to be the safest of all front-steering machines. In this experience I am not alone. A well-known and excellent rider turned more than one somersault, when running down hill on a "Salvo" a few weeks since. This year I have ridden only rear-steerers, without any approach to an accident. Of course, I have ridden carefully when descending steep or very rough hills. Your correspondent is mistaken in supposing that the hill-climbing power of the "Monarch" is due entirely to the small size of the wheels and long cranks. In my "Monarch" the cranks have but 4½ in. throw, while the "Premier" I have has cranks with nearly 6½ in. throw. Many riders besides myself will be sorry if manufacturers generally give up making rear-steering tricycles. I am looking forward to the "Sterling," with its novel application of back-pedalling, being made one of the best machines of the day.—John Browning, L.T.C.

Our Mathematical Column.

I SEND you two questions which I would be glad of a reply to. The first was intended to be given at examination for licensed surveyors in this colony (New Zealand). Your papers on probabilities suggested No. 2.—TOOWOOMBA.

PROB. 1.—*Prove the following method of drawing tangents to a circle from a point* O.



Draw any two chords OAB, *and* OCD. *Let* AD *and* BC *meet in* Y, *and* CA *and* DB *in* X. *Let* XY *meet the circle in* P *and* Q, *then* OP *and* OQ *are the tangents required.*

This property is true if ABDC is any conic section, and is most simply proved as follows:—OAB and OCD being chords from a point O, CA and DB intersect on the polar of O, and so also do AD, BC. Therefore XY is the polar of O, and P, Q, in which XY cuts the conic, are the points in which tangents from O meets the conic.

But Toowoomba's letter suggests that the solution of the problem might probably have been required to be independent of the theory of polars.

Try then the following,—

Take OB, OD as axes of y and x, and let $OC=a$; $OD=\alpha'$; $OA=\beta$; and $OB=\beta'$.

Then the equations to CA, BD, CB, and AD, are respectively—

$$\frac{x}{a}+\frac{y}{\beta}=1; \qquad \frac{x}{\alpha'}+\frac{y}{\beta'}=1;$$

$$\frac{x}{a}+\frac{y}{\beta'}=1; \text{ and } \frac{x}{\alpha'}+\frac{y}{\beta}=1;$$

Hence the equation to XY will be of both the forms

$$\frac{x}{a}+\frac{y}{\beta}-1+m\left(\frac{x}{\alpha'}+\frac{y}{\beta'}-1\right)=0 \qquad \text{(i)},$$

$$\text{and} \quad \frac{x}{a}+\frac{y}{\beta'}-1+n\left(\frac{x}{\alpha'}+\frac{y}{\beta}-1\right)=0 \qquad \text{(ii)};$$

since (i) is the equation of a line passing through X, and (ii) is the equation of a line passing through Y. Obviously the only equation which is of both these forms, and therefore the equation to XY, is obtained by putting $m=n=1$. Hence equation to XY is

$$\frac{x}{a}+\frac{x}{\alpha'}+\frac{y}{\beta}+\frac{y}{\beta'}-2=0 \qquad \text{(iii)}.$$

Now let the equation to the conic ABDC be

$$ax^2+bxy+cy^2+dx+ey+f=0 \qquad \text{(iv)}$$

Put $y=0$, and divide by x^2, giving

$$\frac{f}{x^2}+\frac{d}{x}+a=0$$

The two values of $\frac{1}{x}$ obtained by solving this quadratic are, of course, $\frac{1}{OC}$ and $\frac{1}{OD}$ or $\frac{1}{a}$ and $\frac{1}{\alpha'}$; and we know that this sum $=-d$. Thus,

$$\frac{1}{a}+\frac{1}{\alpha'}=-d, \text{ and similarly } \frac{1}{\beta}+\frac{1}{\beta'}=-e.$$

Hence, equation (iii) may be written

$$dx+ey+2f=0 \qquad \text{(v)}$$

Now let x', y' be the co-ordinates of P, and x'', y'' those of Q, the points in which tangents from O meet the curves ABDC. Then we know that the equations to the tangents at P and Q may be written

$$(2ax'+by'+d)x+(2cy'+bx'+e)y+dx'+ey'+2f=0$$
$$(2ax''+by''+d)x+(2cy''+bx''+e)y+dx''+ey''+2f=0.$$

Since these both pass through the origin, they must be satisfied when $x=0$ and $y=0$; that is, we must have

$$dx'+ey'+2f=0 \qquad \text{and} \quad dx''+ey''+2f=0;$$

Or both the points P $(x'y')$ and Q (x'', y'') lie on (v), that is on the straight line XY. Q. E. D.

[I have given the proof more fully than is necessary. For equation (v) is known to be the equation to the chord through the points in which the tangents from the origin meet the conic (iv)].

PROBLEM 2.—*Having won the first game at whist, it is usual to lay the odds,* 5 *to* 2 *on winning the rubber. How are these odds calculated?*

The odds are incorrect. Independently of the deal, it is an equal chance that the second game is lost, and also an equal chance that the third game is lost; so that the chance is $\frac{1}{2}\times\frac{1}{2}$ or $\frac{1}{4}$ that the rubber is lost by the winners of the first game. The odds are, therefore, 3 to 1 in favour of their winning. With the deal they are rather more than 3 to 1; without the deal the odds are rather less than 3 to 1.—ED.

Our Chess Column.

BY MEPHISTO.

SOME GENERAL REMARKS UPON THE STRATEGY OF THE GAME.

THE FIRST MOVE.

MANY of our readers who know the rudiments of Chess play, cannot follow the analysis of an ordinary game without feeling somewhat disappointed. Such a game will present to them many unintelligible points, which they cannot explain themselves. They wish to know the precise reason for every move. We will endeavour this time to satisfy—and, let us hope, improve—this weaker class of our Chess patrons.

1. P to K4.

We have a lively recollection of the despair of a young man who, when playing with a young lady, was, with great perseverance, asked why people always played 1. P to K4, and why not any other move. The only answer he could give was, everybody begins with that move. This, however, did not satisfy the inquirer at all, who wanted reasons. In our opinion there are various reasons, based on the theoretical foundation of the game. Firstly, the Pawn occupies as nearly as possible the centre of the board, and is intended to form the nucleus of a force which, being centrally posted, has the greatest command over the enemy's camp, both to the right and left. A good position is the first step towards the attack which leads to victory. Secondly, P to K4 liberates two very important pieces, namely, the Queen and the King's Bishop. The more squares your pieces command, the more you limit your opponent's possible moves, and as the game proceeds, if you succeed in concentrating the commanding action of your pieces on one of your opponent's pieces, you will cut off the defence or retreat of such a piece, and capture it; and a Mate is nothing but the successful posting of your pieces in such a commanding position as to cut off the defence or retreat of the hostile King. Like every other potent fact, this proof can also be mathematically demonstrated. By moving 1. P to K4, your Bishop has the command over five squares and the Queen over four—viz., B to R6 and Q to R5. This gives nine moves, and it is impossible by any other first move on the board to obtain the command over nine squares by the pieces liberated. 1. P to Q4 only gives the command over seven squares by the Queen and the Queen's Bishop. This undoubted mathematical inferiority is, however, counterbalanced by the fact that in reply to P to Q4 your opponent cannot reply with the superior move of P to K4, as then the Pawn could be captured, which necessitates P to Q4 in reply to 1. P to Q4. Thirdly, the King's Bishop's Pawn is the weakest point in an opponent's camp, it being only protected by the King, and 1. P to K4 enables B to B4 to follow, also Kt to KB3. Both these pieces indirectly threaten the Pawn on KB7, the Bishop from B4, and the Knight from Kt5, where it might be played to, or the Queen from, R5, where it also might be played prior to or after moving the Knight. Of course, Black has a ready defence, but while he is defending, White develops his forces, and is enabled soon to bring his King into safety by Castling.

1. P to K4.

For the student this is, no doubt, the best reply, although one

other move is possible, which, however, can only be ventured on after a certain proficiency has been obtained in the strategy of the game. This is 1. P to K3, the only object being at once to make impossible all the various combinations in connection with the commanding action of the Bishop on B4. P to K3 also leaves Black liberty of action; for, unlike P to K4, the Pawn is not attacked by White playing 2. Kt to KB3. P to K3 may be followed up by 2. P to Q4, bringing about an equal development of forces. The opening brought about by the reply of P to K3 is called the French defence. Various other first moves are possible for Black, such as 1. P to QB4, the Sicilian defence, and 1. P to QKt3, the fianchetto; but all these moves necessitate P to K3 sooner or later, and therefore belong to that latter category.

Having at some length dwelt upon the general principles that govern an opening, we will now proceed more briefly with a game itself.

1. P to K4	1. P to K4
2. P to KB4	

Temporarily abandoning a Pawn, but on Black taking this Pawn, White will be partly compensated by obtaining a strong centre by being enabled to play P to Q4 later on, which, likewise, threatens Black's Pawn on B5, the defence of which is difficult, and gives White a splendid opportunity for attack.

2. P takes P

Theoretically, Black ought to be able to maintain this Pawn, but the defence is extremely difficult. Should the second player elect not to expose himself to the attack, he can reply either with 2. P to Q4, or 2. B to B4, both of which yield a fair defence.

3. B to B4

This is called the Bishop's Gambit, in distinction from the King's Knight's Gambit, brought about by 3. Kt to KB3.

3. Q to R5 (ch)

It is now generally acknowledged that before giving this check it is advisable to play 3. P to Q4 first, thereby voluntarily giving up the Pawn, but freeing the Queen's Bishop, and relying upon the inferior position of the White King, which ought to tell in the End game.

4. K to Bsq

The only safe move

4. P to QKt4

With the intention of diverting the Bishop from his commanding position.

5. B takes KtP	5. Kt to KB3
6. Kt to KB3	

To displace the Queen from her present position; for instance, by playing Kt to Kt5 Black would threaten Mate by Q to B7, and also threaten the Pawn on R2. Had White played 6. P to K5, Black would have replied with Kt to K5, threatening the same Mate, and also to win the exchange by Kt to Kt 6(ch).

6. Q to R3

7. P to Q3	7. Kt to R4

Threatening Kt to Kt6(ch), retiring the Knight from where it can be attacked by P to K5, and also serving to defend the Bishop's Pawn.

8. Kt to R4

Preventing Kt to Kt6(ch), and with a view to an attack by Kt to B5.

8. Q to Kt4

The intention being to escape the menacing move of Kt to B5 by attacking both the Bishop and the Knight.

9. Kt to B5	9. P to QB3

At first sight 9. P to KKt3 looks better, as it threatens to win a piece should White retire the Kt to Q4 by Black playing B to Kt2. But in reply to 9. P to KKt3, White would have played P to KR4, and, after the Black Queen retiring to KB3, it is clear Black cannot take the Knight, as this would leave his own Knight unprotected, and to be captured by the White Queen with a good game.

10. R to Ktsq.

A magnificent move, the force of which will be seen as the attack, which is thereby initiated progresses.

	10. P takes B
11. P to KKt4	11. Kt to KB3
12. P to KR4	12. Q to Kt3
13. P to R5	

White's object in giving up his Bishop is now more apparent, he closely presses the hostile Queen.

13. Q to Kt4

14. Q to B3

This threatens the dangerous move of Bishop takes Pawn, which Black cannot prevent.

14. Kt to Ktsq

To make room for the Queen.

15. B take P	15. Q to B3
16. QKt to B3	

Further strengthening his attack by threatening Kt to Q5, or Kt takes QKtP.

16. B to B4

17. Kt to Q5	17. Q takes P

Black had nothing better. This is the only move which guards his KKtP against Kt takes P(ch).

18. B to Q6

A most wonderful power of perception. It further embarrasses Black's game. He cannot take that Bishop on pain of mate in four moves as follows. 18. B takes B. 19. Kt takes B(ch), K to Qsq, 20. Kt takes P(ch), K to Ksq. 21. Kt to Q6(ch), K to Qsq. 22. Q to B8 mate. White disregards the loss of his Rooks for the sake of attack.

18. Q takes R(ch)

19. K to K 2

White's object in giving up this second Rook is to be enabled to play Kt takes KtP(ch); it would, therefore, have been better for Black not to take the Rook, but play his Queen to Kt7, so as to defend his Pawn on KKt2 as long as possible.

19. B takes R

20. P to K5

White now threatens mate in two by Kt takes KtP(ch), K to Qsq, and B to B7 mate.

20. Kt to QR3

Black's intention was of course to prevent the check with the B on B7 after Kt takes P(ch) and K to Ksq, but B to R3 would have been better for that purpose, as it would have provided a retreat for the King on QBsq and QKt2. White now effects a mate in three moves in a highly ingenious manner.

21. Kt takes P(ch)	21. K to Qsq
22. Q to B6ch	

Now of course the Knight must take, which enables White to play.

23. B to K7 mate.

We have purposely selected this game, which by some is considered the finest game ever played, and is known as the immortal game in which White was played by the late Professor Andersen and Black by L. Kieseritzky. We hope its perusal will give our readers a good insight into the strategy and combination of Chess.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess-Editor.*

Herbert Jacobs.—Problem will receive attention.

H. B. Kimpton wishes to play a game by correspondence.

Leonard P. Rees.—1. K to Q2 does it.

Mebsuta.—Pray learn the English notation; the King cannot give mate.

J. G.—Problem 49. If B to Bsq, then P takes B, becomes a Queen, and mates.

Correct solutions received of Problem No. 51 by Aryce (etc.), C. S. Bright, T. Wilson Morris, A. Wahltuch, J. K. Milne, Squire, Charles Hartley, John Watson, Sydney Herbert, and Herbert Jacobs.

Problem No. 52.—Geo. H. Bonner, Schmucke, J. K. Milne, H. Seward, Leonard P. Rees, and Berrow.

Problem No. 53.—W. C. Thomas, Berrow, H. Seward, J. K. Milne, Schmucke, Sydney Herbert, Geo. H. Bonner, and Herbert Jacobs.

Incorrect solutions of No. 50, H. G. Watson. No. 51, J. G., A. J. H., F. J. C., and Th. L. Jones. No. 52, W. C. Thomas and Sydney Herbert.

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